

Chapter 1 Pre-Installation

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Introduction

This chapter summarizes the main features of the CMP 200[®] and CMP 200[®] DR X-ray generators (performance, regulatory and compatibility). Safety information is provided, along with environmental, room, and installation requirements. This chapter concludes with a pre-installation checklist and a diagram showing the major component layout.

The information in this chapter is provided in order for the installer to be able to plan the site layout prior to installation of the generator.

Terminology

Direct Radiography	Radiography in which the permanent recording is affected at an image reception area (i.e. film).
Indirect Radiography	Radiography in which the permanent recording is affected after transfer of the information obtained at an image reception area (i.e. digital imaging system).
Direct Radioscopy	Radioscopy in which the visible images are presented at the image reception area, or close to it, in the radiation beam (i.e. fluoroscope or image intensifier with a non-digital imaging system).
Indirect Radioscopy	Radioscopy in which the images are presented at a location outside the radiation beam after transfer of the information (i.e. digital imaging system with a flat-panel detector or with an image intensifier and a CCD camera).
Reference Air Kerma Rate	Air Kerma rate free in air in the primary X-ray beam measured under specific conditions and expressed at the patient-entrance reference point.
Patient Entrance Reference Point	Point intended to represent the intersection of the X-ray beam axis with the entrance surface of the patient.
Isocentre	In radiological equipment with several modes of movement of the reference axis around a common centre, the centre of the smallest sphere through which the radiation beam axis passes.
Entrance Field Size	Dimensions of the field in the entrance plane of an X-ray image receptor that can be used for the transmission of an X-ray pattern under specific conditions.
GenWare[®] Service Software (GenWare[®])	It is a tool to configure the CPI X-ray generator.

Generator Description

The CMP 200[®] 100 kHz high frequency X-ray generator is a component for use in film-based stationary radiographic X-ray systems. The CMP 200[®] DR X-ray generator adds a digital interface for digital radiography (DR) equipment. The CMP 200[®] X-ray generator consists of a main power cabinet and an optional membrane control console. The CMP 200[®] DR X-ray generator consists of a main power cabinet and an optional membrane, touchscreen, mini-console, or mini-console with a pre wired hand switch or a foot switch (used with digital interface). The main power cabinet contains the High Voltage Module and control circuits, the filament drivers, a low speed starter (optional dual-speed starter on some models of CMP 200[®] DR), and interface connections to the room equipment.

The control console allows the operator to select the technique factors, image receptors, etc., and to initiate an X-ray exposure.

Features

The following are the main features of and the options available for the generator:

- Integral low speed starter, compatible with X-ray tubes with type “R” stator. Optional compatibility with GE 23/23 Ω equal impedance “E” stator
- Optional dual-speed starter on all models of CMP 200[®] DR, compatible with tube types listed in the X-ray Tube Stator Compatibility Tables supplement, part number 74602600
- Capable of interfacing with various DR imaging systems (CMP 200[®] DR only)
- 24 VDC, 110, or 220 VAC power source for Buckys (fused at 0.8 amps)
- 24 VAC 150 watts power source for collimator lamp
- 24 VDC 45 watts power source for system locks
- Optional AEC
- Optional DAP (Dose-Area Product)
- Optional 24 VDC, 75 Watts, regulated, un-switched 2.5 Amp DIN Rail mounted power supply (intended for use with LED collimators)
- Tomography

Radiographic Performance

Table 1-1A: Radiographic performance

kVp range:	40 kV to 125 kV or 40 kV to 150 kV, depending on model
kVp steps:	variable in 1 kV steps
kVp accuracy:	$\pm (5\% + 1 \text{ kV})$ measured 5 ms after the beginning of the exposure; $\pm 2\%$ between 70-80 kVp Measured between the 75% points of the kV waveform
Rise time (10%-90%):	<1.5 ms (typically < 1.0 ms) with 30 m (100 ft) Locaflex L3 or equivalent HV cables
Time range:	1.0 to 6300 milliseconds
Exposure time Steps:	Variable in 1 ms steps via protocol; Variable according to ISO 497 Series R'20 via CPI consoles
Exposure Time Accuracy:	$\pm (2\% + 0.5 \text{ ms})$ from 5 ms to 6300 ms and $> 0.5 \text{ mAs}$ $\pm (10\% + 1 \text{ ms})$ for $> 0.1 \text{ mAs}$ and for $< 5 \text{ ms}$ or $\leq 0.5 \text{ mAs}$ for 30 m (100 ft) HV cables Measured between the 75% points of the kV waveform
mAs range	0.1 to 500 mAs (32/40 kW) 0.1 to 630 mAs (50 kW) 0.1 to 800 mAs (65 kW) 0.1 to 1000 mAs (80 kW) Note for Minimum mAs: mAs Mode : 0.3 mAs ($> 60 \text{ kV}$, 28 mA, 11 ms) mA, ms Mode: 0.3 mAs ($> 60 \text{ kV}$, 10 mA, 30 ms) mAs or mA, ms Mode: 0.1 mAs (40 kV - 60 kV, 10 mA, 10 ms)
mAs accuracy:	$\pm (10\% + 0.2 \text{ mAs})$ for $> 0.5 \text{ mAs}$ $\pm (10\% + 0.05 \text{ mAs})$: 0.1 mAs – 0.5 mAs (preliminarily specified for the range beyond IEC standard)
mA range	10 to 400 mA (32 kW) 10 to 500 mA (40 kW) 10 to 630 mA (50 kW) 10 to 800 mA (65 kW) 10 to 1000 mA (80 kW)
mA steps:	Variable in 0.1 mA steps via protocol; Variable according to ISO 497 Series R'20 via CPI consoles (see Generator Exposure Tables in Appendix A of this manual)

Table 1-1A: Radiographic performance

mA Accuracy (10 mA – 1000 mA):	± (5% +1 mA) for exposures ≥ 5 ms and > 0.5 mAs; measured 5 ms after the beginning of the exposure across a 10 Ω, 1% resistor at the HVM mA F/B terminals. ± (20%) mA for exposures > 0.1 mAs and for < 5 ms or ≤ 0.5 mAs; (0.1 – 0.25 mAs, mA ≥ 50 mA); measured between the 75% points of the kV waveform measured across a 1 Ω, 1% resistor at the HVM mA F/B terminals.
Coefficient of linearity:	≤ 0.1 (Station to Station) for exposures ³ 25mA or 3.2ms
Coefficient of reproducibility:	≤ 0.05 for a set of kV and mAs parameters
Duty Cycle:	Not to exceed 5 consecutive boosts, followed by a minimum 10 second wait period
Note: The product of kV and mA is constrained by the maximum power rating. The kV ripple is constrained by the minimum cable capacitance shown in the <i>Minimum High Voltage Cable Requirements</i> section of this chapter.	

Audible Noise Specification

The audible noise is measured at a distance of 1 meter from the generator and 1 meter off the ground the **maximum Audible Noise Level is 62 dBA**.

Note: The audible noise is measured with the generator operating at worst-case scenario; fans running at high speed and tube spinning at high speed. The **average** audible noise level will be significantly lower since for the vast majority of exposures and clinical operating conditions the fans function at low speed and only increase to high speed as dictated by high power exposures, high duty-cycle exposures, and the generator thermal algorithm.

Output Parameter and Loading Factor

Table 1-1B: Output Parameter and Loading Factor		
Output Parameter	Generator Series	Loading Factor
Maximum X-ray tube voltage and highest X-ray tube current at that voltage	32 kW	125 kV, 250 mA / 150 kV, 200 mA
	40 kW	125 kV, 320 mA / 150 kV, 250 mA
	50 kW	150 kV, 320 mA
	65 kW	150 kV, 400 mA
	80 kW	150 kV, 500 mA
Maximum X-ray tube current and highest X-ray tube voltage at that current	32 kW	400 mA, 80 kV
	40 kW	500 mA, 80 kV
	50 kW	630 mA, 80 kV
	65 kW	800 mA, 81 kV
	80 kW	1000 mA, 80 kV
Combination of X-ray tube current and X-ray tube voltage resulting in highest output power	32 kW	320 mA, 100 kV
	40 kW	400 mA, 100 kV
	50 kW	500 mA, 100 kV
	65 kW	630 mA, 103 kV
	80 kW	800 mA, 100 kV
Highest constant output power at 100 kV, 0.1 sec	32 kW	320 mA, 100 kV, 0.1 s
	40 kW	400 mA, 100 kV, 0.1 s
	50 kW	500 mA, 100 kV, 0.1 s
	65 kW	630 mA, 100 kV, 0.1 s
	80 kW	800 mA, 100 kV, 0.1 s
Nominal shortest irradiation time (AEC exposures)	All models (AEC control is available over the full kV and mA range)	< 2 ms with a dedicated or 3 of 5 field AEC board. AEC control is achieved by varying the ms of the exposure. The AEC ms range is 15 ms to an installer-programmable maximum not to exceed 600 mAs.

Environmental Specifications

Table 1-2: Environmental Specifications

OPERATING	
Ambient temperature range	10 to 40 °C (50 to 104 °F)
Relative humidity	20 to 80%, non-condensing
Atmospheric pressure range	1060 to 700 hPa (-400 to +3000 meters, 795 to 525 mm Hg); Reference: 1013 hPa nominal at sea level
TRANSPORT AND STORAGE	
Ambient temperature range	-20 to 70 °C (-4 to 158 °F)
Relative humidity	5 to 95%, non-condensing
Atmospheric pressure range	1060 to 700 hPa (-400 to +3000 meters, 795 to 525 mm Hg); Reference: 1013 hPa nominal at sea level
<ul style="list-style-type: none"> • Electrolytic capacitors contained within the equipment require less than +40 °C for long-term storage life. • The membrane control console is limited to a minimum temperature of -20 °C, with a maximum duration of 48 hours at that temperature. Transport and storage is limited to a maximum duration of 120 hours between 50 and 70 °C, with an absolute humidity not to exceed the humidity of 85% RH at 50 °C. • Touchscreen console temperatures below -20 °C and above +50 °C are limited to 10 days maximum duration, with a humidity not exceeding 50 % RH. 	

Safety

Safety and Warning Symbols

The following advisory symbols are used on the safety warning labels, and/or on circuit boards, and/or on the operator console.



High voltage symbol used to indicate the presence of high voltage



Warning symbol used to indicate a potential hazard to operators, service personnel or to the equipment



This is a radiation exposure symbol used on operator console. Lights indicate that an exposure is in progress. This is accompanied by an audible tone from the console.

WARNING

This X-ray unit may be dangerous to patient and operator unless safe exposure factors, operating instructions and maintenance schedules are observed.

Radiation warning label on operator console

Never allow unqualified personnel to operate the X-ray generator.

Safety Notices and Warnings

Warnings:

- *This X-ray unit may be dangerous to patient and operator unless safe exposure factors, operating instructions and maintenance schedules are observed.*
- *Proper use and safe operating practices with respect to X-ray generators are the responsibility of users of such generators. CPI Canada Inc. ("The Manufacturer") provides information on its products and associated hazards, but assumes no responsibilities for after-sale operating and safety practices.*
- *The Manufacturer accepts no responsibility for any generator not maintained or service according to this service and installation manual, or for any generator that has been modified in any way.*
- *The Manufacturer also assumes no responsibility for X-ray radiation overexposure of patients or personnel resulting from poor operating techniques or procedures.*
- *Do not modify this equipment without authorization of the Manufacture*

- *Hazardous voltages exist inside the generator whenever the main power disconnect is switched ON. These areas include, but are not limited to, the main fuse holder and associated circuits on the HV auxiliary board, the auxiliary transformer, the voltage doubler, and the main power contactor. LED DS1 ON the HV auxiliary board indicates the presence of the +24 VDC supply.*
- *The console ON/OFF switch DOES NOT disconnect the main power from the above areas inside the generator.*
- *The DC bus capacitors under the inverter board(s) and on the voltage doubler board above the HVM, present a safety hazard for at least 5 minutes after the power has been removed from the unit. Check that these capacitors are discharged before servicing the generator.*
- *LEDs connected across the DC bus indicate the presence of high voltage. These LEDs are mounted on the EMC board (On some models, the EMC capacitor board DOES NOT contain any components other than the LED and the series resistors) and on the voltage doubler board.*
- *Do not rely solely on bleeder circuits and high-voltage on indicators in the generator to protect you. Due to the possibility of component failure, it must never be assumed that an unlit LED ensures that no high voltage is present. Using a voltmeter, confirm that no high voltage is present before attempting any service.*
- *An arc flash is an electrical discharge of current that travels through the air and can produce temperatures approaching 20,000 degrees Celsius; This can cause severe burns to exposed skin and damage the eyes of the installer/service personnel. The mains input and generator capacitor bank are areas where a potential arc flash can occur. To minimize the risk of injuries from an arc flash, the installer/service personnel must wear the proper personal protective equipment (PPE) and work in accordance with the local regulations regarding arc flash hazards.*
- *Servicing the X-ray generator involves bending, being in an awkward position, reaching into hard to reach areas, and working at bottom position such as when routing wires, etc. Always take precautions and consider ergonomics to prevent hand scrapes and scratches, muscles strain or injuries when working on the generator.*
- *Installation of the generator must be done in accordance with the local regulations.*
- *Connection of the mains input cable must be done by a licensed electrician in accordance with the local electrical code.*

X-ray radiation exposure may be damaging to health, with some effects being cumulative and extending over periods of many months or even years. Operators and service personnel should avoid any exposure to the primary beam and take protective measures to safeguard against scatter radiation. Scatter radiation is caused by any object in the path of the primary beam and may be of equal or less intensity than the primary beam that exposes the film.

No practical design can incorporate complete protection for operators or service personnel who do not take adequate safety precautions. **Only authorized and properly trained service and operating personnel should be allowed to work with this X-ray generator equipment.** The appropriate personnel must be made aware of the inherent dangers associated with the servicing of high voltage equipment and the danger of excessive exposure to X-ray radiation during system operation.



Do not connect unapproved equipment to the rear of the console.

For the membrane console, J3 is for connection of an external hand switch, J4 is a serial port for use by an external computer, and J8 is for the interconnect cable to the main cabinet.

For the touchscreen console, COMM1 on the bottom of the touchscreen is for the interconnect cable to the generator, COMM2 is the serial port for use by the digital system, ETHERNET 1 and ETHERNET 2 are standard 10/100 Ethernet connections, the two USB ports for connection of external devices such as a DAP printer or a USB key.

Incorrect connections or use of unapproved equipment may result in injury or equipment damage.

Cautions:

- *Do not exceed the tube maximum operating limits. Intended life and reliability will not be obtained unless generators are operated within published specifications.*

Note:

- *The installer must provide a visual indication of the ON/OFF state of each external device that can prevent the generator from emitting radiation, or that can stop the generator from emitting radiation, or both.*
- *All electrical work performed during installation and service of this X-ray generator must be performed in accordance with CSA standard Z462 or equivalent.*

The following notes apply to the touchscreen console only.**Warnings:**

- *The intended use of this touchscreen console is strictly for controlling the CPI generator and should never be used for any unrelated or any other windows-based applications.*
- *The touchscreen console has no used serviceable parts. Do not attempt to open the touchscreen console.*
- *Ensure there is sufficient area around the venting slots of the touchscreen console to allow proper cooling of the internal components.*
- *Do not connect unapproved equipment to any part of the console.*
- *Peripheral devices should be IEC 60601-1 approved if located in the patient area.*
- *Use only the power supply provided with the console. Do not substitute the power supply provided with any other type.*
- *All components used for this touchscreen application are non-serviceable and must be replaced directly by CPI parts provided cannot be substituted.*
- *Incorrect connections, substituting of parts or use of unapproved equipment may result in injury or equipment damage.*
- *Routine maintenance suggests checking for loose console hardware, worn or defective cabling, and worn or loose tie wraps every 6 months.*
- *Never place liquid near the console.*
- *No practical design can incorporate complete protection for operators or service personnel who do not take adequate safety precautions.*
- *The touchscreen should be adjusted or positioned to avoid equipment damage or personal injury.*

Note:

- *Clean surface with a piece of non-abrasive material between the touchscreen and the surface.*
- *For wall mounted touchscreen consoles, ensure that the base is secured properly to a wall stub.*
- *Ensure the touchscreen console is resting on a flat and clean surface.*

Safety Warning Labels

This subsection defines the safety labels used inside and outside the generator cabinet.

Warnings:

- *Switch off the mains power disconnect and allow sufficient time for all capacitors to discharge before removing any covers.*
- *If any covers must be removed for service, take all required precautions with respect to the hazard(s) and immediately replace the covers when the need for removal is completed.*



Replace all fuses in this generator with the same type and rating

Refer to Table 9-2A and 9-2B of [Information of Fuses](#) (chapter 9: Spares) for fuse replacement information



Refer to the [Battery Replacement](#) procedure (Chapter 6: Regular Maintenance)

This information is provided to help you establish safe operating conditions for both you and your X-ray generator. Do not operate this X-ray generator except in accordance with these instructions and any additional information provided by the X-ray generator manufacturer and / or competent safety authorities.

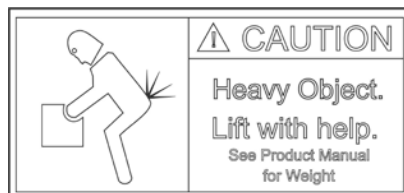
Note:

- *These labels and warnings are provided to alert service personnel that serious injury will result if the hazard identified is ignored.*

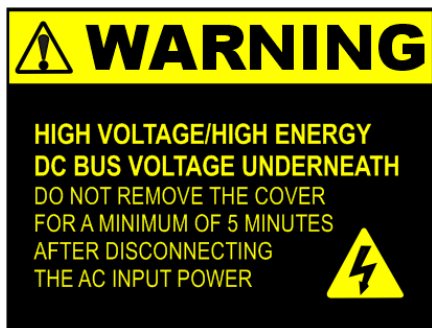


Refer to instructions

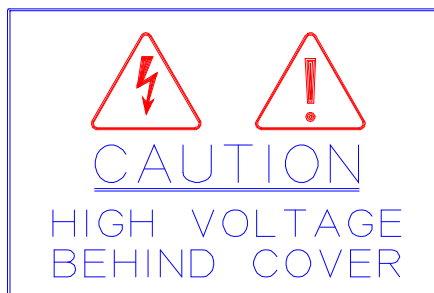
Weight Label



This label is attached to the main generator cabinet and to the High Voltage Module. Do not attempt to lift these items without proper assistance. The weight of the generator and the High Voltage Module is listed in the [Dimensions, Cable Entrance and Seismic Center Location](#) section of this chapter.

Caution HV/High Energy Warning Label

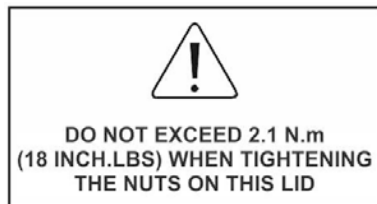
This label is attached to the generator cabinet and on the inside of the back cover above the High Voltage Module. The DC bus capacitors (approximately 300 to 670 VDC, depending on model) will remain charged for up to 5 minutes after the AC mains is disconnected or the console is switched off.

Caution HV Behind Cover Label

This label is attached to the outside of the generator cabinet, the cover over the inverter assembly, the cover over the DSS board and the fan cover. The Mains voltage is present inside the cabinet whenever the main disconnect is switched on. Additionally, the DC bus capacitors will remain charged for up to 5 minutes after the AC mains is disconnected or the console is switched off.

Warnings:

- *Wait a minimum of 5 minutes after the input mains power has been removed before removing any covers. Once the cover(s) are removed. Check that the voltage across the DC bus capacitors is near zero before servicing. If this voltage exceeds 50 VDC, qualified service personnel must manually discharge the capacitors.*

High Voltage Module - Transformer Terminals Notice

This notice is printed on the High Voltage Module lid and cautions against over-tightening the nuts on the transformer feedthrough terminals (for the primary of the HV transformers).

Danger High Voltage Notice



**DANGER
HIGH VOLTAGE**

This notice is printed on the high voltage module lid. High voltage may be present at the primary terminals on the high voltage module lid board, at the output high voltage connectors, and at the mA/mAs measuring jacks if the shorting link is opened for mA/mAs measurements.

Auxiliary Transformer Labels



This label is fixed on the outer face of the auxiliary transformer to indicate the presence of high voltage taps on the primary of 120, 200, 240, 400 and 480 VAC. Ensure the main power disconnect is switched off and appropriate documentation is consulted before attempting to service this component.



HIGH VOLTAGE HAZARD: Be certain that you are aware of all potential high voltage locations and hazards as detailed in this section before removing any covers, or attempting any service on this X-ray generator.



HIGH VOLTAGE HAZARD: Approximately 400 VAC is present on the membrane console board in the area of T1, C36, and J5. This is a high voltage source for the fluorescent backlight on the LCD display.

HIGH VOLTAGE HAZARD: AC mains voltage and / or DC bus voltage (approximately 325 to 670 VDC, depending on model) is present on the H.V. auxiliary board and the voltage doubler board whenever the AC mains is energized. Ensure that the AC mains is switched off and locked out before servicing this board. See the note below regarding the DC bus voltage.

HIGH VOLTAGE HAZARD: High voltage is present on all components connected to the AC mains (line fuses, auxiliary transformer, H.V. auxiliary board, main power contactor, discharge resistor mounted on the DSS2 metal panel beside voltage doubler board, voltage doubler board, and etc.) whenever the AC mains is switched on. Additionally, DC bus voltage is present on certain components (mains rectifier assembly, DC bus capacitors, inverter assembly, High Voltage Module, H.V. auxiliary board, etc.) whenever the generator is switched on, and will remain on for up to 5 minutes after the console is switched off or the AC mains is switched off or disconnected.

HIGH VOLTAGE HAZARD: Approximately 600 VDC is present on the dual-speed starter board whenever the generator is switched on. This voltage is sourced from the DC bus capacitors in the generator, and therefore the high voltage hazard will remain for up to 5 minutes after the generator has been switched off.

High voltage (approximately 325 to 670 VDC, depending on model) is present on the inverter assembly and associated components whenever the AC mains is energized and the console is switched on, and for up to 5 minutes after the console is switched off or the AC mains is disconnected. **This combination of high voltage and high current is potentially lethal. Use extreme caution when servicing this unit.**

Preparing for Installation

Generator Heat Output

The maximum heat output of the main generator cabinet is less than 1000 BTU / hour in normal clinical use, with a maximum of 70 BTU / hour heat output for the console. The console is convection-cooled, and the main cabinet is fan cooled. The console and main cabinet should never be covered when the generator is switched on, as any covering may interfere with the cooling. The cooling vents must be unobstructed at all times.

Generator Power Requirements

The tables in this section show mains power requirements for various configurations of CMP 200[®] and CMP 200[®] DR X-ray generators. The installer must ensure that the generator is connected to the proper mains voltage as per the nameplate on the generator. **Notes** for all the **400** VAC line input voltages listed in this section:

Table 1-3A: Generator Power Requirements for 380/400 VAC Line Input Voltage

380 VAC / 400 VAC Line Voltage:	The generator may be operated with a line input voltage of 380 VAC -5% / +15%. If the generator must be installed with a line input voltage below 360 VAC (400 VAC -10% or 380 VAC -5%) then a 3-phase line matching auto-transformer may be used. The 3-phase line matching auto-transformer must meet the minimum requirements specified below:	
	Input	380 VAC 50 / 60 Hz
	Output	400 VAC ±10%
	Momentary Output Current	As specified below for each power level
	Continuous Output Rating	Same as the Minimum Recommended Distribution Transformer Rating specified in Table 1-4

Table 1-3B: Generator Power Requirements for 32 kW Generator

Line Voltage	208 VAC - 5% to 230 VAC + 10%, 1 phase 208 VAC - 5% to 230 VAC + 10%, 3 phase 400 VAC \pm 10%, 3 phase 480 VAC \pm 10%, 3 phase
Line Frequency	50/60 Hz.
Momentary Current	220 Amps at 208 VAC (1 phase) 120 Amps / phase at 208 VAC (3 phase) 200 Amps at 230 VAC (1 phase) 110 Amps / phase at 230 VAC (3 phase) 65 Amps / phase at 400 VAC 55 Amps / phase at 480 VAC
Nominal Current *	\leq 5 Amps
Momentary Power Consumption	See Table 1-4

Table 1-3C: Generator Power Requirements for 40 kW Generator

Line Voltage	208 VAC - 5% to 230 VAC + 10%, 1 phase 208 VAC - 5% to 230 VAC + 10%, 3 phase. 400 VAC \pm 10%, 3 phase 480 VAC \pm 10%, 3 phase
Line Frequency	50 / 60 Hz
Momentary Current	275 Amps at 208 VAC (1 phase) 150 Amps / phase at 208 VAC (3 phase) 250 Amps at 230 VAC (1 phase) 135 Amps / phase at 230 VAC (3 phase) 80 Amps / phase at 400 VAC 65 Amps / phase at 480 VAC.
Nominal Current *	\leq 5 Amps
Momentary Power Consumption	See Table 1-4

Table 1-3D: Generator Power Requirements for 50 kW Generator

Line Voltage	208 VAC - 5% to 230 VAC + 10%, 3 phase 400 VAC \pm 10%, 3 phase 480 VAC \pm 10%, 3 phase
Line Frequency	50/60 Hz
Momentary Current	185 Amps / phase at 208 VAC 170 Amps / phase at 230 VAC 100 Amps / phase at 400 VAC 80 Amps / phase at 480 VAC
Nominal Current *	\leq 5 Amps
Momentary Power Consumption	65 kVA

Table 1-3E: Generator Power Requirements for 65 kW Generator

Line Voltage	400 VAC \pm 10%, 3 phase 480 VAC \pm 10%, 3 phase
Line Frequency	50/60 Hz
Momentary Current	125 Amps / phase at 400 VAC 105 Amps / phase at 480 VAC
Nominal Current *	\leq 5 Amps
Momentary Power Consumption	85 kVA

Table 1-3F: Generator Power Requirements for 80 kW Generator

Line Voltage	400 VAC \pm 10%, 3 phase 480 VAC \pm 10%, 3 phase
Line Frequency	50/60 Hz
Momentary Current	155 Amps / phase at 400 VAC 130 Amps / phase at 480 VAC
Nominal Current *	\leq 5 Amps
Momentary Power Consumption	105 kVA

- * Nominal Current = Generator standby current only. External or installer-supplied equipment connected to the generator may increase the nominal current beyond the values shown.

Table 1-10 defines the power line requirements for the generators.

Note:

- *Table 1-10 contains recommended values for the wire sizes between the mains disconnect and the generator. The actual values used at an installation are dependent on the quality of the input line (voltage level), the current requirements, and the length of the cable run, and must be confirmed by the installer.*
- *Final selection of generator input wire and disconnects as well as the cabling from the distribution transformer to the mains disconnect must meet the requirements of the local electrical codes, and is usually determined by hospital / contractor engineering.*
- *The ratings listed consider the generator requirements only. The installer must make the necessary compensation for additional load requirements.*
- *A poor quality input line may result in the installer having to de-rate the generator's maximum power.*

Table 1-4: Generator Power Line Requirements

Generator Series and Mains Voltage	Minimum Recommended Mains Disconnect to Generator (15 ft/5 m max)	Generator Momentary Line Current	Minimum Recommended Generator Service Rating	Minimum Recommended Distribution Transformer Rating	*Minimum Recommended Ground Wire Size	Apparent Mains Resistance
32 kW 208 VAC, 1p	#2 *** (33 mm ²)	220 A	120 A	45 kVa	#2 (33 mm ²)	0.045 Ω
32 kW 230 VAC, 1p	#2 *** (33 mm ²)	200 A	120 A	50 kVa	#2 (33 mm ²)	0.055 Ω
32 kW 208 VAC, 3p	#4 ** (21 mm ²)	120 A	100 A	45 kVa	#4 (21 mm ²)	0.07 Ω
32 kW 230 VAC, 3p	#4 ** (21 mm ²)	110 A	100 A	45 kVa	#4 (21 mm ²)	0.09 Ω
32 kW 400 VAC, 3p	#6 ** (13.3 mm ²)	65 A	100 A	45 kVa	#6 (13.3 mm ²)	0.27 Ω
32 kW 480 VAC, 3p	#6 ** (13.3 mm ²)	55 A	100 A	45 kVa	#6 (13.3 mm ²)	0.40 Ω
40 kW 208 VAC, 1p	#2 *** (33 mm ²)	275 A	120 A	65 kVa	#2 (33 mm ²)	0.035 Ω
40 kW 230 VAC, 1p	#2 *** (33 mm ²)	250 A	120 A	65 kVa	#2 (33 mm ²)	0.045 Ω
40 kW 208 VAC, 3p	#4 ** (21 mm ²)	150 A	100 A	55 kVa	#4 (21 mm ²)	0.055 Ω

Use and disclosure is subject to the restrictions on page II of this CPI document.

Table 1-4: Generator Power Line Requirements

Generator Series and Mains Voltage	Minimum Recommended Mains Disconnect to Generator (15 ft/5 m max)	Generator Momentary Line Current	Minimum Recommended Generator Service Rating	Minimum Recommended Distribution Transformer Rating	*Minimum Recommended Ground Wire Size	Apparent Mains Resistance
40 kW 230 VAC, 3p	#4 ** (21 mm ²)	135A	100 A	55 kVa	#4 (21 mm ²)	0.075 Ω
40 kW 400 VAC, 3p	#6 ** (13.3 mm ²)	80 A	100 A	55 kVa	#6 (13.3 mm ²)	0.22 Ω
40 kW 480 VAC, 3p	#6 ** (13.3 mm ²)	65 A	100 A	55 kVa	#6 (13.3 mm ²)	0.32 Ω
50 kW 208 VAC, 3p	#2 *** (33 mm ²)	185 A	100 A	65 kVa	#2 (33 mm ²)	0.045 Ω
50 kW 230 VAC, 3p	#2 *** (33 mm ²)	170 A	100 A	65 kVa	#2 (33 mm ²)	0.055 Ω
50 kW 400 VAC, 3p	#6 ** (13.3 mm ²)	100 A	100 A	65 kVa	#6 (13.3 mm ²)	0.17 Ω
50 kW 480 VAC, 3p.	#6 ** (13.3 mm ²)	80 A	100 A	65 kVa	#6 (13.3 mm ²)	0.24 Ω
65 kW 400 VAC, 3p	#6 *** (13.3 mm ²)	125 A	100 A	85 kVa	#6 (13.3 mm ²)	0.13 Ω
65 kW 480 VAC, 3p	#6 *** (13.3 mm ²)	105 A	100 A	85 kVa	#6 (13.3 mm ²)	0.19 Ω
80 kW 400 VAC, 3p	#6 *** (13.3 mm ²)	155A	100A	105 kVa	#6 (13.3 mm ²)	0.10 Ω
80 kW 480 VAC, 3p	#6 *** (13.3 mm ²)	130A	100A	105 kVa	#6 (13.3 mm ²)	0.15 Ω

* Refer to the [Generator Ground Requirements](#) section of this chapter for general grounding information. Maximum wire gauge is # 2 AWG Cu (33 mm²).

** Maximum wire gauge is # 4 AWG Cu (21 mm²).

*** Maximum wire gauge is # 2 AWG Cu (33 mm²).

Recommended Service Disconnect (as per Table 1-10):

All wiring and grounding should comply with the national electrical code or equivalent.

All wiring must be copper.

The disconnect switch shall be located within reach of the operator.

Generator Ground Requirements

A suitable ground must be connected from the disconnect switch to the main ground of the generator, located to the right of the main fuse block, on the sub-panel. The ground wire is typically part of the line cord, and the current capacity of the ground conductor must normally be equal to or greater than that of the line conductors.

A copper ground cable, #10 AWG (6 mm²) or larger should be connected from the X-ray tube housing to the High Voltage Module ground stud (located at the top of the High Voltage Module).

If a neutral line is provided with the system, under no circumstances is it to be used for ground purposes. The ground must carry fault currents only.

Minimum High Voltage Cable Length Information

One of the properties of the generator high voltage cables is capacitance. This capacitance performs an important function in that it filters the generator output ripple. As a result the CMP 200[®] X-ray generators must be fitted with a minimum length (minimum capacitance) of high voltage cable. This minimum cable length is specified in Table 1-5:

Table 1-5: Mini High Voltage Length Information				
kW/Line Voltage	Phase	Maximum kV Rating	Minimum Cable Capacitance	Minimum Cable Length ¹
80 kW, 400/480 VAC	3 p	150 kV	1540 pF	10.7 m (35 ft.)
65 kW, 400/480 VAC	3 p	150 kV	1320 pF	9.1 m (30 ft.)
50 kW, 400/480 VAC	3 p	150 kV	1320 pF	9.1 m (30 ft.)
50 kW, 208/230 VAC	3 p	150 kV	880 pF	6.1 m (20 ft.)
40 kW, 400/480 VAC	3 p	150 kV	880 pF	6.1 m (20 ft.)
32 kW, 400/480 VAC	3 p	150 kV	880 pF	6.1 m (20 ft.)
40 kW, 400/480 VAC	3 p	125 kV	1320 pF	9.1 m (30 ft.)
32 kW, 400/480 VAC	3 p	125 kV	1100 pF	7.6 m (25 ft.)
40 kW, 208/230 VAC	3 p	125 kV	1100 pF	7.6 m (25 ft.)
32 kW, 208/230 VAC	3 p	125 kV	880 pF	6.1 m (20 ft.)
40 kW, 208/240 VAC	1 p	125 kV	1100 pF	7.6 m (25 ft.)
32 kW, 208/240 VAC	1 p	125 kV	880 pF	6.1 m (20 ft.)

¹ Based on a cable capacitance of 145 pF/m (44 pF/ft.)

X-ray Stator Drive Cable Requirements

The X-ray stator cable used with the starter assembly has to meet the following requirements:

The cable must be approved to at least 600 VAC if using a dual-speed starter and at least 300 VAC if using a low speed starter.

The cable must be shielded and the shield ground must be connected to the generator chassis ground and to the tube housing ground.

Note: For Metal Centre Section X-ray tubes, **DO NOT** connect the shield ground to the tube housing ground.

The maximum cable capacitance (from the inner conductors shorted together to the cable shield) **must be less than 4.4 nF**.

Note: If a longer cable is necessary with larger cable capacitance over 5.1 nF, consult the manufacturer.

Locating and Mounting the Generator

The main generator cabinet is self-standing and does not need to be supported. However, the installation should meet the following requirements:

- The floor must be flat and level.
- The generator installation area must be clean and free of dirt or debris.
- The installer must supply generator hold-down brackets, if required. Alternately, mounting holes have been provided in the base of the generator. The generator may then be anchored to the floor via these holes.
- Sufficient room must be provided to allow access to the rear and side of the generator for installation and service. See Figure 1-1 for recommended clearances.
- The main cabinet is fan cooled, therefore room-temperature air must be free to circulate around the cabinet. The cooling vents must be unobstructed at all times.
- A cable trough, conduit, or raceway (1 in; 2.5 mm, diameter) should be provided from the control console to the main cabinet to allow routing of the control cable if required.
- The control console is normally freestanding on a desk or shelf. It may be anchored if necessary.
- Do not place any objects regardless of size or weight on the generator.

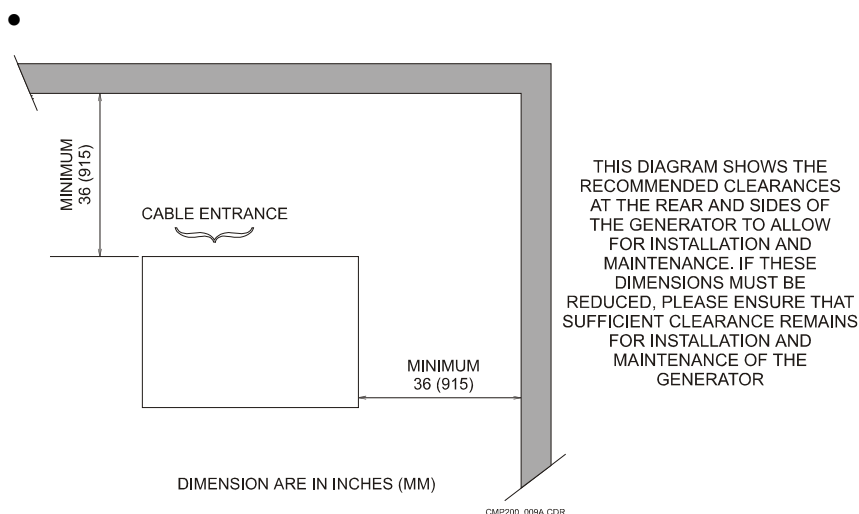


Figure 1-1: Generator clearances

Dimensions, Cable Entrance and Seismic Center Location

Figure 1-2 shows the dimensions of the generator cabinet, the locations of the cable access slots, the AC mains cable entry, and the seismic center location for the CMP 200® / CMP 200® DR X-ray generator.

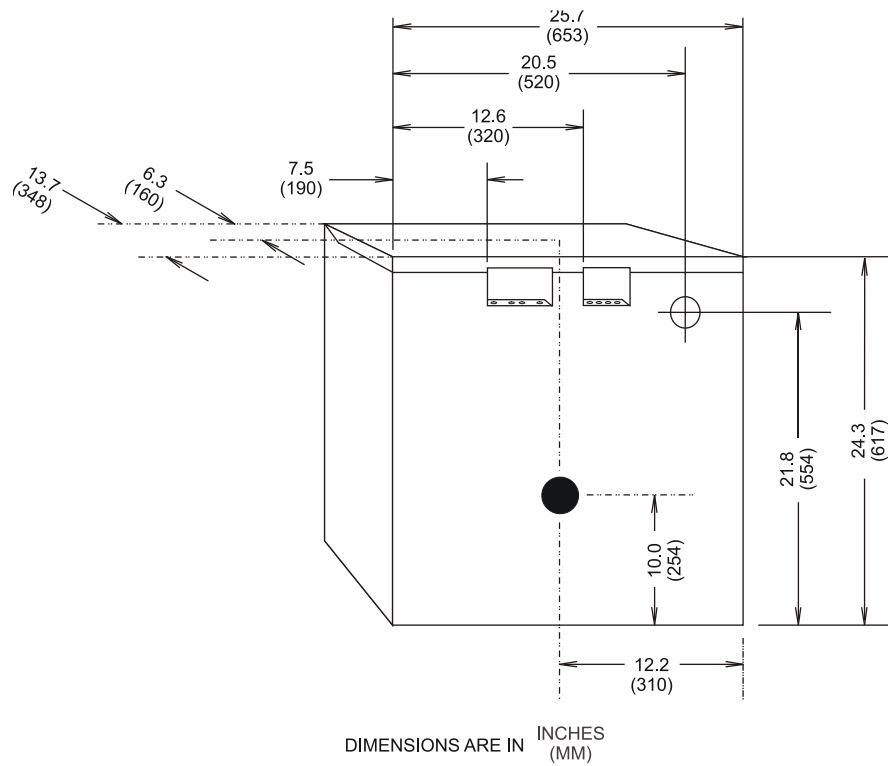
The dimensions and weight of the generator and control console(s) are shown in Table 1-6.

Table 1-6: Dimensions and Weights of Generator and Control Consoles				
ITEM	LENGTH	WIDTH	HEIGHT	WEIGHT
Main cabinet in Standard shipping pack	30.5 (775)*	21.5 (546)*	38 (965)	120 (53) -170 (77)
Main cabinet unpacked	25.7 (653)*	13.7 (348)*	24.3 (617)*	95(43) – 145(66)
High Voltage Module		12.0 (305)	10.5 (267)	42 (19)
High Voltage Module		12.0 (305)	14.0 (356)	48 (22)
Membrane console	12.3 (313)**	10.9 (277)**	3.7 (94)**	6 (2.72)
Touchscreen control	See Figure 1-3			

* Refer to Figure 1-2

** Refer to Figure 1-3

The above dimensions are inches (mm); weights are in pounds (kg). The weight of the generator is dependant on the power supply and the options configured.



CMP200_013B.CDR

Figure 1-2: CMP 200[®] / CMP 200[®] DR Cable entry locations and seismic center

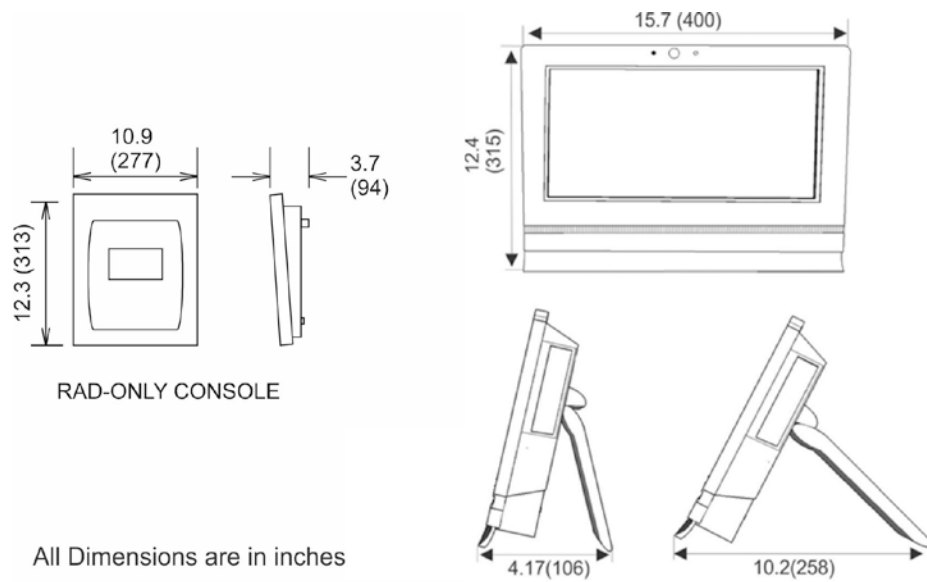


Figure 1-3: CMP 200[®] / CMP 200[®] DR operator console dimensions

Tools and Test Equipment Required

The following is a checklist of recommended tools and test equipment for installation and calibration of the generator.

CHECK <input checked="" type="checkbox"/>	DESCRIPTION
	General hand tools for installation: Wrenches, nut drivers, assortment of screwdrivers, pliers, etc.
	If the generator is to be anchored to the floor, suitable tools (i.e. drill, drill bits, etc.) and mounting hardware must be available.
	A supply of connectors for wiring: terminal lugs, caps, splices etc.
	A calibrated DVM that indicates true RMS voltages
	Dual trace memory oscilloscope with a minimum 20 MHz bandwidth; appropriate leads, probes, etc.
	Device for measuring true kVp, which may be a Dynalyzer equivalent or a non-invasive meter such as the Keithley TRIAD system
	A calibrated radiation meter with detectors that will allow for R/min and uR type measurements (or uGy and Gy/min)
	A suitable mA / mAs meter
	A strobe or reed type tachometer to verify that the anode is rotating up to speed
	A sufficient selection of absorbers to allow AEC calibration if this option is fitted: A suggested selection is Lexan in thickness of 5.0, 10.0, and 15.0 cm, or water in plastic containers of homogenous density in thickness of 5.0, 10.0, and 15.0 cm.
	Vapor proof compound for the HV terminations

Pre-Installation Checklist

Before starting the generator installation, review the following checklist.

CHECK √	DESCRIPTION
	Is there an unloading area to transport the generator from the delivery truck to the inside of the building?
	If the installation is not on the same floor as the delivery entrance, is there an elevator available?
	Is there a transport dolly or similar device to move the generator?
	Do any regulatory bodies need to be notified prior to installation?
	If movers are required, have arrangements for time and equipment been completed?
	Are lifting straps or some other suitable device available to lift the generator off the shipping pallet?

Generator Layout and Major Components

Figure 1-3 shows the external view and dimensions of the membrane and touchscreen operator's consoles. Figures 1-4 and 1-5 show the major components located inside the generator cabinet. Figure 1-6 is an internal view of the console, showing the major components and cabling. Figure 1-4 does not represent all models. This is meant to show major component layout only.

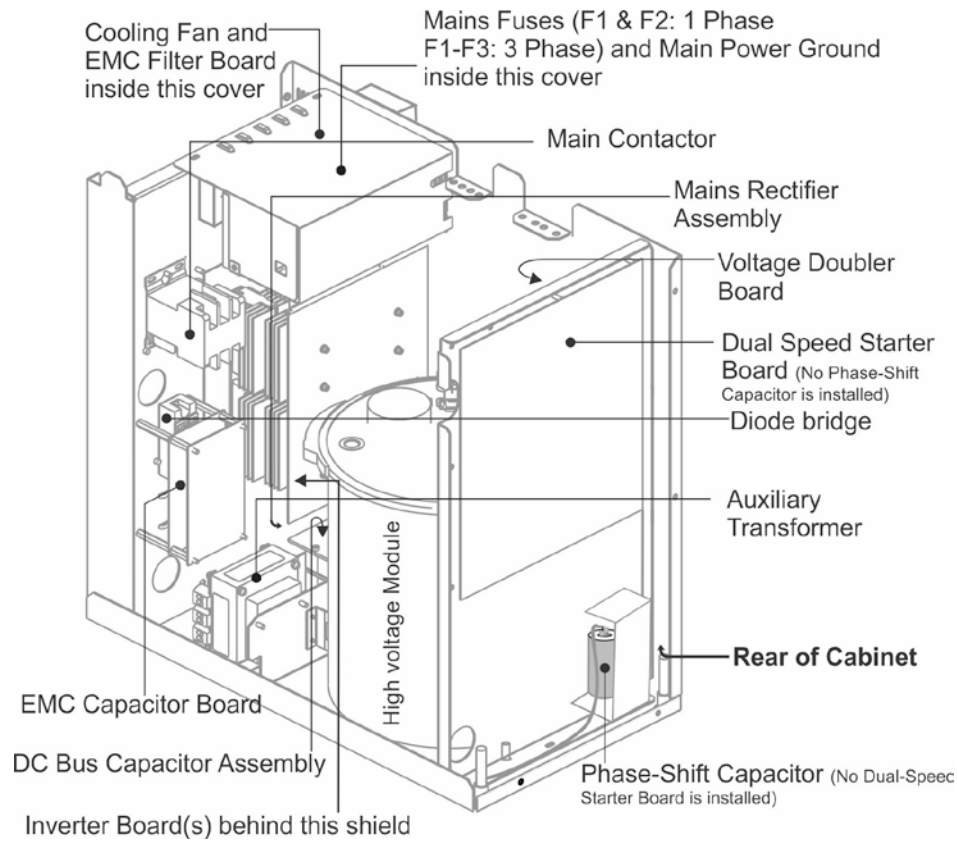


Figure 1-4: Major generator subassemblies view 1

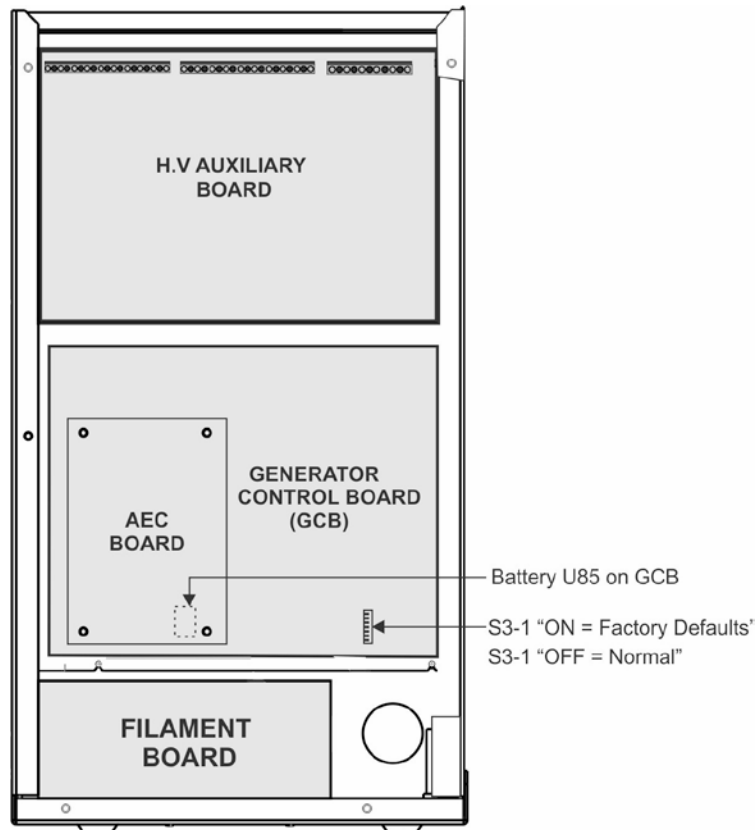


Figure 1-5: Major generator subassemblies view 2

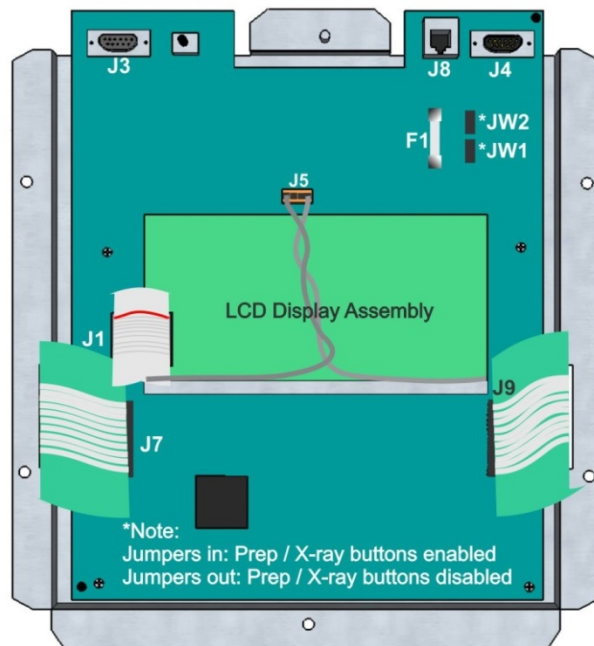
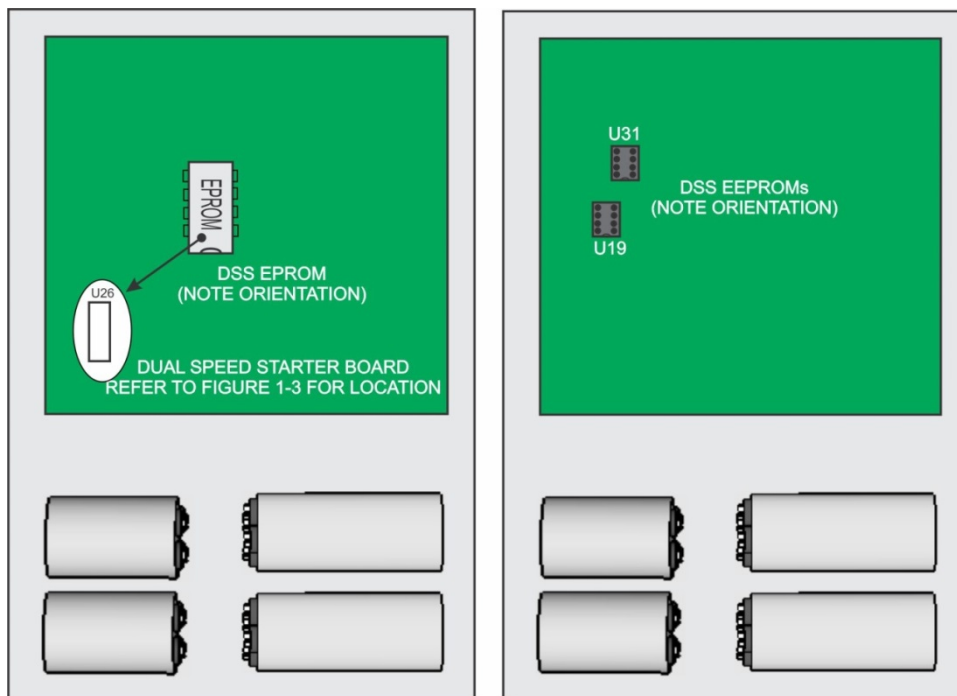


Figure 1-6: Console internal view



Board Assembly #728877 Board Assembly #903132
 Figure 1-7: EPROM and EEPROM Locations

Compatibility Listing

This X-ray generator is compatible with the following equipment:

X-RAY TUBES:

Refer to the *X-ray Tube Stator Compatibility Tables* supplement and Chapter 2, *Installation*, of this manual.

Note:

- Refer to the “*Low Speed Starter Tube Compatibility*” of the X-ray Tube Stator Compatibility Tables supplement or the “*Programming the Dual-Speed Starter*” procedure in chapter 2, *Installation*, of this manual for further details.

AEC DEVICES:

Refer to the Product Configuration / Compatibility Statement included in the document set.

DR INTERFACE:

Refer to the Product Configuration / Compatibility Statement included in the document set.

Runtime License Agreement (Touchscreen Console)

User / End User License Agreement

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Compatibility Statement

The compatibility statement for this generator is located at the front of this manual.

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